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MOBILE COMMERCE ADOPTION: END-USER/CUSTOMER VIEWS

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ABSTRACT

A number of research articles published recently emphasize the strong potential of mobile commerce, the competitive advantage it might bring to providers and to developers, and the benefits to be enjoyed by private and commercial end-users. On the other side, voices from the industry declare that mobile commerce has failed to deliver and that the initially rapid uptake has slowed down. The literature on mobile commerce is rich in frameworks and models, which vary in form from general to application-specific. To study this rapidly evolving phenomenon, we propose a research model which includes the relationships between users, the technology, and the mobile commerce value chain.

INTRODUCTION

Many recently-published research articles emphasise the strong potential of mobile commerce and the competitive advantage it brings to communication services providers and developers of mobile content. Users and business using mobile commerce business models will enjoy a variety of benefits provided by mobile applications through the supporting infrastructure (Barnett et al, 2000; Muller-Versee, 2000; Senn, 2000; Varshney et al, 2000; Siau et al, 2001; Barnes, 2002; Lembke, 2002). At the same time, a number of articles in the industry press announce that mobile commerce has failed to deliver, and that the promising start has slowed down (Hayward, 2002 as quoted in Goldfinger, 2002). One of the most promising mobile commerce applications – mobile banking, has been termed both a 'killer application' (Kannan et al, 2001) and a 'dead end' (Semrau & Kraiss, 2001).

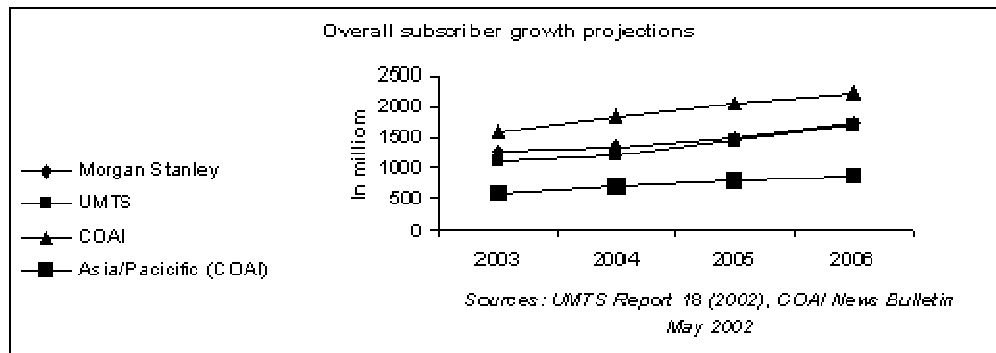
Professional writers caution against the optimistic projections which predicted that the uptake of mobile commerce would be faster than that of electronic commerce, particularly in the area of Business-to-Consumer (B2C) applications (Dano, 2001; Stahl, 2002). Most authors agree that some of the downturn in the mobile commerce arena is in line with a general downturn of the economy, and while predictions about the penetration of wireless devices are still optimistic (Figure 1), the question of whether mobile commerce will live up to its expectations as a "revenue machine" has not yet been answered affirmatively (Rupp & Smith, 2002).

Even so, research interest in mobile commerce has not faded. It is a new frontier of electronic commerce and a new driver in the process of "eTransformation", spearheaded by electronic commerce. Numerous attempts to build up a recognisable research space for mobile commerce have led to the creation of research constructs such as general frameworks, application-specific scenarios, transactional models, and evaluation and adoption frameworks. In this paper, we review some of these approaches, and attempt to synthesize them into a preliminary research model for the study of mobile commerce adoption.

A significant number of mobile applications are expected to emerge from the Asia-Pacific region where New Zealand is well-positioned in terms of mobile phone penetration (Dholakia & Dholakia, 2002). A report published by the New Zealand Ministry of Economic Development (MED, 2002) states that about 60% of the total population had access to a mobile phone in 2001. This figure compares favourably with the 1999 mobile penetration figures of early mobile commerce adopters such as Finland and Sweden (66.70% and 57.80%, respectively). Reports in the

business press suggest that the lack of more acceptable and attractive applications is one of the reasons for the relatively slow uptake of mobile commerce (African Cellular, 2003). There is a need for mobile commerce solutions which recognise the importance of user perceptions of mobility. Securing end-user support and acceptance is a necessary condition, to be met by any player in the mobile commerce arena who wants to devise a successful mobile commerce strategy and benefit from the mobile commerce opportunity (Nohria & Leestma, 2001).

Figure 1: Mobile penetration - predictions for 2003-2006



In the sections which follow, we will review some existing mobile commerce (mCommerce) research models and will propose a preliminary research model for the study of mCommerce adoption – starting with a definition.

MOBILE COMMERCE AND APPLICATIONS

A definition of mCommerce as a transaction is provided by Muller-Versee (2000): mCommerce is “any transaction with a monetary value conducted via a mobile telecommunications network”. As a subset of electronic commerce, mCommerce incorporates mobile transactions to the Internet. Some of the studies of electronic commerce penetration and adoption provide models and instruments suitable for similar studies involving mCommerce uptake (Pedersen, 2001).

Mobile commerce is different from electronic commerce in at least one aspect: its unique feature is “user mobility”, which makes mCommerce dynamically dependent on the location in which the mobile user operates. Schneiderman (2000, p.1) points out that “...unlike electronic commerce, which normally requires desktop computers to connect to the Internet and send and receive e-mail, mobile commerce offers the added benefit of mobility that makes conducting business or making a purchase via the Internet an anywhere, anytime experience”.

A broader definition of mCommerce is needed, which includes applications that take into account the exact location of the user and provide customised, location-aware services. Following Kalstrom (2000), we define mCommerce as a “value-added service that enables mobile end-users to conduct reliable and secure transactions through specifically-designed mobile applications”.

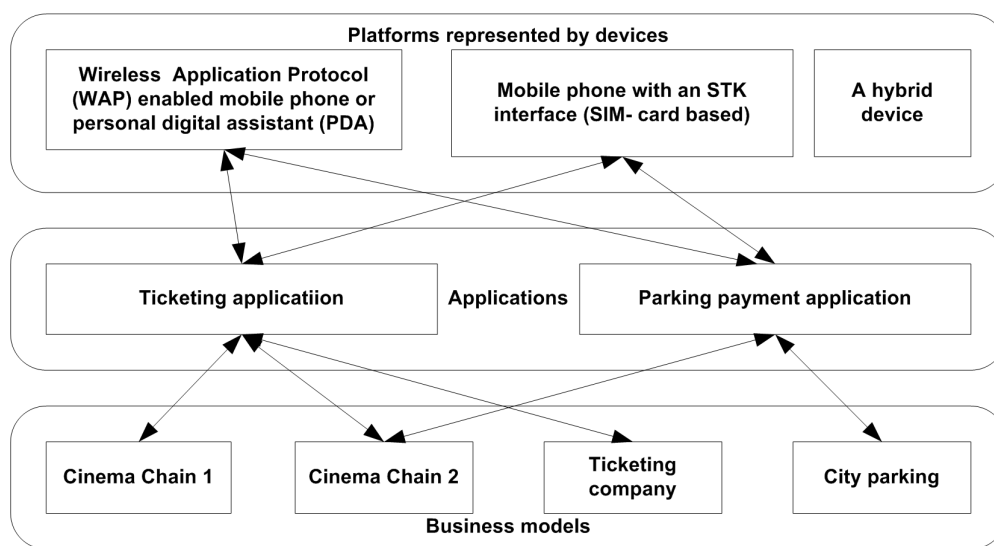
“Applications” are one of the entities in the relationship diagram in Figure 2. These include, for example, applications in banking and brokerage, shopping, reservations and ticketing, entertainment, event management, education (Varshney & Vetter, 2002). In the context of our definition, mobile applications are applications designed for mobile handheld devices. The handheld devices connected to mobile networks belong to the entity labelled “platforms” in Figure 2.

Applications add value to the end user or customer when they become part of the business model in a firm or organization. The business model provides an architecture for conducting mCommerce (Veijalainen et al, 2002), including a description of the relations between the players: “...customers, operators, eCommerce providers, payment providers, and other parties” (Lehner & Watson, 2001).

The definitions above identify three distinct components of mCommerce - business models, applications and supporting infrastructure - which are represented as entities in the relationship diagram in Figure 2. Customers conduct mobile commerce via mobile devices (“platforms”). Suppliers develop suitable business and pricing models to offer a range of mobile services and applications. Adoption by customers occurs as mobile applications are implemented in the context of the business model to deliver value.

In the current mCommerce landscape, business models implement diverse applications based on a variety of platforms. Taking as examples mobile ticketing (MeT, 2003) and mobile parking payment (Heijden & Valiente, 2002) we can see how one platform (SMS) might be able to support different applications, while a single application might also be supported on multiple platforms (ticketing on WAP and SMS). Interestingly, the same application might be employed by different business models – for example a cinema offering both mobile ticketing and parking services. The evident complexity in the relationships between mCommerce entities makes it necessary to develop models for the study of adoption.

Figure 2: Relationships between platforms, applications and business models



MOBILE COMMERCE MODELS

There are several “players” in the mCommerce scene: providers of platforms, developers of applications and middleware, content and service providers and end-users. Using the relationship diagram above as a reference, in this section we briefly describe several of the “player-oriented” models found in the literature. The value chain model is discussed first, which includes players on the supply side. The value proposition model attempts to link the supply and the demand sides. The reference model proposed by Varshney (2001) provides a framework including all possible players and interactions (Table 1).

The Value Chain Model

The value chain model represents the players involved in adding value to the mCommerce service or product. Value chain models focus on intermediaries and treat mCommerce as a service provided through information and telecommunications (ICT) infrastructure. The value chain participants are aligned with their respective ICT industries, and interact sequentially through value-adding activities. The three major groups of players identified in literature are platform vendors and operators, application developers and service providers (Barnett et al, 2000; Miller-Versee, 2000; Siau et al, 2001). These major groups correspond to the “platform” and “application” entities

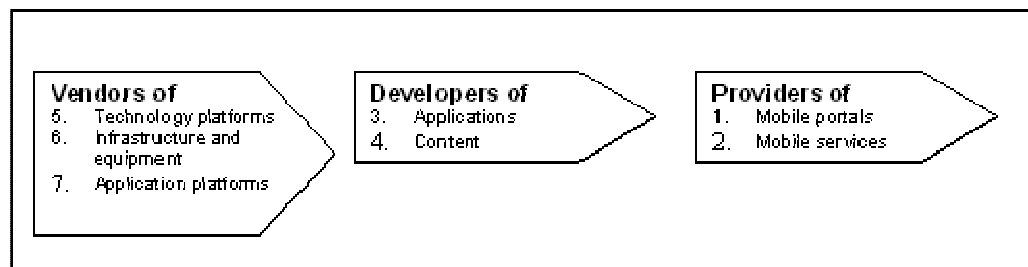
in the mCommerce relationship diagram (Figure 2). The simple *linear value chain* model (Schot, 1997) lacks a user-centric view of mCommerce, and is difficult to apply in the study of mCommerce adoption. The linear model also cannot be extended to include other types of eCommerce, such as consumer-to-consumer (C2C) interactions. The *multidimensional value chain model* overcomes some of these limitations, and several variants of the multi-chain models exist; examples include the “process based double-value chain” (Barnes, 2002), the “future scenario” model (Muller-Versee, 2000) and the “extended mobile communication value chain” (Buellingen & Woerter, 2002).

Table 1: Examples of models used in the research literature on mCommerce

Model		Extensibility	Source
Value-chain	Linear	Does not provide a clear customer focus or interface to frameworks for studying adoption	Barnett et al, 2000; Muller-Versee, 2000; Siau et al, 2001; Olsson & Nilsson, 2002.
	Multi-dimensional	Includes some of the end-user interactions with the value chain	Muller-Versee, 2000; Barnes, 2002; Buellingen & Woerter, 2002.
General	Value-proposition	The focus is on the customer (the user as a consumer of value-added services)	Clarke III, 2000; Anckar & D’Incau, 2002.
	Open two-plane framework	Provides a four layer user plane, can be extended to include a consumer adoption view	Varshney et al, 2000; Siau et al, 2001; Varshney, 2001; Varshney & Vetter, 2002

A generalised value chain model is shown in Figure 3, where three links incorporate the major groups of players in the value chain. “Vendors” provide the basic technology and application platforms and equipment). “Developers” provide content in formats suitable for mobile devices, and enable personalised applications (Turban, 2004, p. 399). Vendors and developers do not interact directly with the end-users of the applications. “Providers” of mobile services and portals operate the interface needed to conduct mCommerce.

Figure 3: A value chain model for mCommerce



The importance of the mobile portal as user access point is increasing with the process of convergence between platform vendors, content developers and mobile services (Petrova, 2002; Barnes, 2002; Buellingen & Woerter, 2002). The process of convergence is characterised by a competition for portal ownership. An example of the convergence process is the case of mobile network operators (vendors) offering both content and payment services to customers (such as micro payments for news messages).

As the portal market expands and roles with the value chain are re-defined, the structure of the value chain changes dynamically and becomes more complex and non-sequential through multiple points of interaction with the end user. Alternatives, such as the value proposition and open framework models, attempt to accommodate this change in structure.

Alternatives to the Value Chain

Clarke's *value proposition approach* (Clarke III, 2000) considers the bundle of four key value dimensions (ubiquity, personalization, localization, and convenience), which give mCommerce a competitive advantage over traditional electronic commerce, and constitute the "value-for-time" proposition of mCommerce. The end-user response to a particular mobile application depends on the amount of the added "value-for-time". As "value-for-time" is the key dynamic determining the success of a mobile application, its four value dimensions offer value-proposition based framework for studying mCommerce adoption. According to Clarke's hypothesis, mCommerce will reach its potential through the adoption of business models which offer maximum effectiveness and value to the consumer.

Ankar and D'Incau (2002) suggest an extension to Clark's value proposition, which splits the overall "wireless channel value" into a wireless component (value contributed by the mobile technology in bypassing wired communications channels), and a mobile component (the value emerging from the mobility-related features of a handheld device). The authors hypothesise that mCommerce applications create different value in different settings. A survey was conducted to evaluate the suitability of a number of mCommerce applications and services by assessing their perceived mobile value. One of the survey's major findings of the survey was that "[consumers] recognise particularly the mobile value arising from time-critical and spontaneous needs". This result is in line with Clarke's value-for-time hypothesis and demonstrates the usefulness of the value proposition approach in studying mCommerce adoption. A fundamental component of "business models" entity in Figure 2 is the value-proposition aspect of mobile commerce.

Finally, Varshney et al (2000) provide a general reference model for mCommerce. The suggested framework consists of two planes - "users" and "providers/developers". The user plane is divided into four layers (network infrastructure, middleware, user interface and mobile applications). The framework assumes the existence of interfaces between the layers and between the planes, but does not define them and is open to include any future developments as separate "players" in the value chain develop their own connections to the user plane. Thus, Varshney's interfaces hide the complexity of mCommerce implementations.

The open-framework model has certain advantages over the value chain model, as it puts together users and providers; however it does not include the business model through which a mobile application adds value to the user, which the value-proposition approach does.

END-USER VIEWS

We propose to study the end-user adoption of any given mCommerce application based on the value proposition approach: we postulate end-user (or customer) adoption as a function of the organization's ability to offer mobility-related value to the end-user through a suitable business model. To illustrate how mCommerce generates mobility-related value and to derive some of the important defining characteristics of mCommerce, we will consider first several examples which illustrate the role played by the mCommerce entities ("platform", "application" and "business model") in providing a value proposition.

In the case of the *platform* entity, mobility-related value is the capability to connect to the network at any time and from any place. For example, the mobile network operator provides instant connectivity and coverage.

In the case of the *application* entity, a portal or another form of an intermediary hosts and supports a mobile service. Additional mobility-related value is created in a specific context: for example, mobile banking is a service used in the context of "any time, any location" ("ubiquity"). Another specific service context is "localization": examples include a vehicle driver obtaining route directions (Bisdikian et al, 2002), or a spectator following a cross-country rally (Olsson & Nilsson, 2002). Applications designed for vehicle drivers belong to the class of 'telematics' applications.

The *business model* entity generates mobility-related value by providing relevant and timely content to a subscribed customer or end-user. An example of such model is a notification service where a frequent train traveller pays a subscription to receive updates on train delays on his mobile phone. The updates are generated by the railway

company and are relayed to an SMS portal which in turn sends them to the individual traveller. The customer can update his travel plans accordingly. The examples above illustrate some of the features of mobility.

The literature on mCommerce offers a number of other examples and illustrations (see for example Muller-Versee, 2000; Al-Qirim, 2002; Turban, 2004, p. 423) which we have summarised in Table 2. Each of the factors described in the table contributes to the *value proposition* of a mobile service.

Table 2: Mobile commerce related factors

Factor	Description
Customer Ownership	Ownership of subscriber data
Personalization	Using subscriber data to personalize the user interface with the application and to customize the end-user experience
Localization	Enabling the provision of services related and relevant to a mobile customer's location
Ubiquity	The ability of the end-user to receive information and perform transactions from any location
Timeliness /instant connectivity	Delivering time-sensitive information . The ability to connect to the service instantly
Convenience	Applications which “make life easier”, without too much customer involvement in the technicalities of the service. Applications which overcome the limitations of the mobile handheld device
Cost	What the customer pays for the connection, for the mobile device and for the service
Bandwidth	The ability to transmit across the network rich content – including voice, video, multimedia and text
Availability and interoperability of devices and protocols	Enabling the delivery of services across different networks and devices, providing platform “transparency” . Coverage of geographic areas
Social factors	Issues arising from concerns about privacy and security of information, and about access to the technology

The value proposition as offered to a customer through the *business model*, using the relevant mobile application across one or more *platforms*. The mobile application is hosted and is supported by a portal or a solution provider; we will use the term “*intermediary*” rather than the term “application” in order to give a broader meaning to this entity. (In different value chains, different intermediaries might be involved, or they might converge; we are interested in their role in generating overall mobility-related value, regardless of the exact configuration of the value chain).

Table 3 provides a breakdown of the roles played by mobile commerce entities in relationship to each factor. Not all factors are involved in the creation of mobility-related value. The “true” mobility factors are “Ubiquity”, “Timeliness” and “Localization”. These features are not characteristic for a non-mobile eCommerce application. They take advantage of the mobility capabilities provided through the mobile platform, and are related to the available network capacity (for instance – bandwidth, or access points).

'Personalization' and 'customer ownership' play a special role in mCommerce due to the commercial nature of the mobile infrastructure: mobile networks are proprietary and there is no open public access to them (as there is with the Internet). Therefore personalization of services is possible based on subscriber data already collected; in contrast, in Web-based eCommerce data about the profile of the customer must be supplied by the customer first. This makes personalization relatively easy to implement with the purpose of adding value to a mobile service but might bring questions about privacy ('social factors').

'Convenience' is not a specific factor for the generation of mobility-related value, but the related issue of 'usability' plays a significant role in influencing user acceptance of devices with small screens and keyboards (Chan

et al, 2002). 'Interoperability' refers to the ability to run an application on different platforms transparently to the end-user, making the business model independent of the implementation aspects. The transparency is provided by the intermediary.

Table 3: Mobile commerce entities and their roles

	Platform	Intermediary	Business model
Ubiquity	Provides “global” coverage	Provides the real-time context	Provides the content of the service (for example mobile banking)
Timeliness	Provides instant connectivity	Enhances services with added features such as “alerts”	Provides the content of the service (for example stock trading information)
Localization	Provides “local” coverage	Provides the localization context	Provides the localized content of the service (for example, region-wide)
Personalization & customer ownership	Owns subscriber data	Owns subscriber data, personalizes the interface	Provides content which depends on personal choice (for example one-to-one marketing)
Convenience	Provides devices with improved usability features	Provides user friendly interface	Provides content which improves “quality of life”
Cost	Devices and connection	n/a	Might be explicit or bundled (for example, ticket purchase with built-in instant notification)
Interoperability / bandwidth	Devices & networks - standards, middleware	Provides transparency, hides the interoperability issues	Provides media intensive content
Social factors	Privacy of customer data	Privacy of customer data	Security of sensitive information, liability in case of non-timely delivered information, the risk involved in delivering mission critical but wrong information

Finally, 'cost' is the one single factor which might make adoption impossible, acting as a consumer barrier; in general the trend is towards lowering the costs of network connectivity - especially in the climate of strong competition among mobile services providers.

The analysis shows that with regard to bringing mobility-related value to the customer, the roles of the platform, the intermediary and the business model are clearly differentiated. Based on this we propose a preliminary research model for the study of mCommerce adoption which includes the three corresponding end-user views (Figure 4). It can be explained as follows:

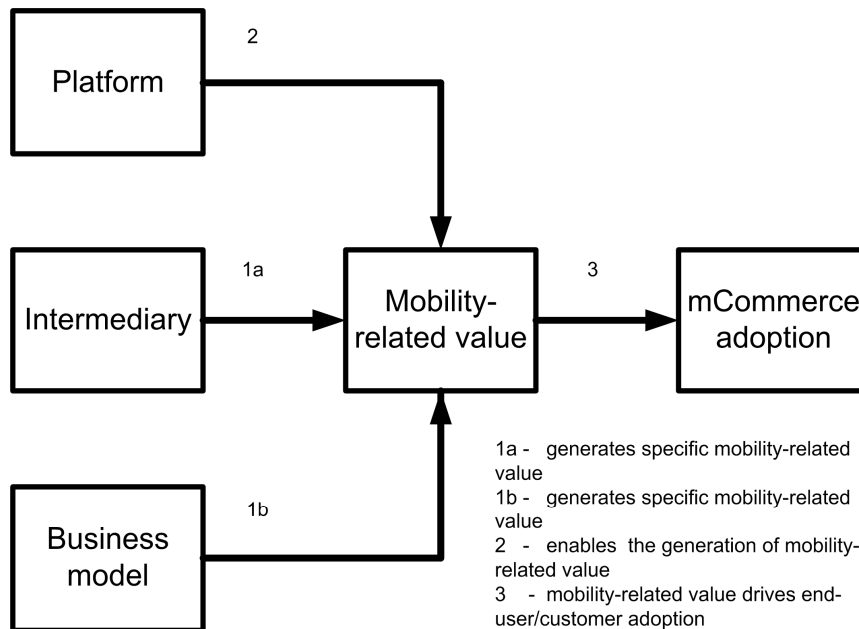
- The adoption of mCommerce depends on the mobility-related added value (relationship 3)
- The organizations' business model and the intermediary (which could be a portal) are the independent variables of the model (relationships 1a and 1b)
- The mobile platform might be an independent variable but might also play a moderating role (relationship 2).

The variables in the model can be operationalized through three groups of factors as identified earlier in Table 2 and in Table 3. These include:

- mobility factors (timeliness, localization, ubiquity, personalization);
- factors related to support (interoperability and usability);
- social factors (cost, access, privacy and security concerns).

To emphasise the contribution of the proposed model to the literature on mCommerce and to identify the possible approaches to establishing its external validity, the following section provides a focused review of four frameworks suggested in the literature in the period 2001-2002 and compares them to the model in Figure 4.

Figure 4: A preliminary research model for mCommerce adoption



RELATED RESEARCH FRAMEWORKS

The model in Figure 4 represents a nomological net of five constructs and the relationships between them, providing a link between the theoretical mCommerce models discussed earlier and their possible “observable manifestations” (Cronbach & Meehl, 1955). It incorporates the three major players in the mCommerce value chain (the constructs labelled “platform”, “intermediary”, and “business model”) and includes end-users/customers through the construct “adoption”. The model is underpinned by the value proposition approach and offers three rich perspectives on mobility-related value and its role as a major driver of Commerce adoption. The model does focus exclusively neither on end T users/customers, nor on the interactions within the value chain but encompasses all processes and factors involved. Next we highlight some of its advantages when compared to two adoption-oriented research frameworks (Pedersen et al, 2001-2002; Stanoevska-Slabeva, 2002) and to two classification frameworks (Tarasewich et al, 2002; Chen et al, 2001).

While mCommerce adoption studies can be aligned with the more general information technology adoption research, Pedersen (2001) and Pedersen et al (2002) suggest that the approach is somewhat limited. They also point out that models based either on technological requirements (such as Varshney’s two-plane framework) demand (such as value-chain models) is not sufficient to provide a foundation for the understanding of the adoption of mCommerce services. Subsequently, they propose an adoption framework which triangulates three different end-user perspectives: the end-user as a “technology user”, the end-user as a “consumer” and the end-user as a “network member”. In this approach, end-user requirements and perceptions can be studied combining the three perspectives two-by-two. To illustrate their ideas, Pedersen et al produce a set of sample evaluation questions relating to the triangulation framework; the questions can be used to evaluate any given mobile service from the user point of view. Clearly, two of Pedersen’s perspectives can be matched to the user views developed in our research model:

“technology user” in Pedersen et al corresponds to the “platform user view” in the proposed model, and similarly, “consumer”(Pedersen et al) matches the “business model view”. However, Pedersen’s triangulation does not provide a perspective corresponding to the “intermediary user view” in our model. Another difference is the treatment of the perspectives: in our model the construct “platform” can be treated not only as an independent, but also as a moderating variable.

In contrast to Pedersen et al, Stanoevska-Slabeva (2002) explores a layered representation: adapting the existing “media reference model” already used to study electronic commerce adoption she develops a “reference model for mCommerce applications”. All players in the value chain and the customers/end-users are included. However there is no differentiation between the roles of the platform, the intermediary and the business model. Compared to the research model proposed in the previous section, Stanoevska-Slabeva’s model is static: it does not provide perspectives on the process of creating mobility-related value but is limited to identifying the process participants.

To study the phenomenon of mCommerce as a whole, Tarasewich et al (2002) develop a three-dimensional “classification system for mCommerce issues”. It includes a “geographic impact” dimension, an “organization impact” dimension and a “technical level” dimension. Each dimension represents a continuum of issues and is used to generate a set of issue-related research questions. It can be seen that the research questions generated by the “continuum of issues” can be transformed into research questions relevant to the research model proposed above. One of the issues identified by Tarasewich et al generates, for example, the question: “Do variations in pricing affect the use of mCommerce services?” The constructs “platform” and “Business model” can be used to investigate the answer to the question through a study based on relationships 1b and 2.

And finally, let us consider the three-dimensional framework proposed in (Chen, Lee and Cheung (2001). It incorporates the value chain model as one of the dimensions (named “value chain for mobile commerce”) and has two other dimensions similar to the ones found in Varshney’s open framework (the “technical support for mobile commerce” dimension and the “mobile commerce applications services and products” dimension). As in Varshney, each dimension is layered. The authors of the framework envisage it used to “...find some blank space that is still waiting for fulfillment so that we may propose some possible products and services”. Other proposed applications are market analysis and research dealing with mCommerce’s societal impact. The framework is not designed specifically for end-user adoption and does not include a user perspective. However, if incorporated into the business model construct, the comprehensive business strategy perspective developed by Chen, Lee and Cheung might expand the scope of the proposed research model .

It should be added that there is a strong research interest in studying mCommerce business models (see for example Camponovo & Pigneur, 2002) but the review of that particular aspect of the literature is outside the focus and the scope of this paper.

CONCLUSION

We suggested a relationship model for mCommerce and were able to validate its structure through existing reference, supply and demand models known at the time of writing this paper. Based on the analysis of mCommerce factors and the roles of the mCommerce entities in the creation of mobility-related value, we proposed a preliminary research model for the study of mCommerce adoption. We compared this model to other mCommerce adoption or reference models which include end-users/customers. We were able to establish that none of them differentiates sufficiently between the roles of the intermediary and the business model as independent variables in the adoption process. The next steps in this ongoing research project will be to refine our research questions and develop and test suitable research instruments, and then proceed with the data collection process. We hope also to be able to compare our results to other results reported in the literature, based on the common points with the models reviewed in the previous sections. The ultimate objective of the research and data analysis would be to reach conclusions able to assist decision-making in the area of developing mCommerce applications and implementations.

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